

# Development of Land Affected by Contamination: A Guide for Developers



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## INTRODUCTION

Land contamination may arise from a previous use of a site, or an adjacent site, that has had an industrial, commercial or landfilling activity. Land contamination can have significant adverse effects on human health, property, ecosystems and water quality (e.g. streams, rivers, lakes and groundwater) and needs to be managed appropriately.

This guidance document has been prepared for developers and their agents/advisers who may be involved in assessing and managing land contamination in Wales. It aims to outline the information required by Local Planning Authorities (LPA) in order for them to determine planning applications and then the subsequent discharge of associated land contamination conditions. This guidance document provides an overview of good practice for land contamination management procedures which, if followed, will help meet the information requirements of the LPA during development of that land.

At all times, it is the responsibility of the developer to follow good practice and identify the nature, scale and extent of land affected by contamination, and if required, undertake remediation work to ensure suitability of the land for the proposed development. The LPA does not have a duty of care to the landowner.

This guidance represents the culmination of a co-operative effort involving the Welsh Local Government Association (WLGA) and Environment Agency Wales (EAW). *This document replaces the group's previous guidance document 'Land Contamination: A Guide for Developers (WLGA 2006)'.*

## 1. LOCAL PLANNING AUTHORITY CONSULTATION PROCESS

### 1.1. General Approach

The potential for land contamination is a material planning consideration when a new planning application is assessed by the LPA, but it is the developer's responsibility to ensure that development of the site is suitable for its proposed use.

The LPA has a duty to consider potential land contamination when determining individual planning applications and is responsible for decisions made under the planning system. However, the LPA is minded to consult statutory consultees, including the Local Authority's Pollution Control / Environmental Health departments (PC/EH) for advice on applications where land contamination is a reasonable possibility. In addition, the LPA may consult relevant external bodies such as EAW. The LPA can consult EAW and PC/EH about work that is intended to be undertaken at all stages of the application process, including the recommendation (and subsequently discharge) of planning conditions for the permission.

When considering planning applications on sites where land contamination is a reasonable possibility, or known to exist, PC/EH has to be satisfied that the development will remove existing unacceptable risks to human health, property, ecosystems and water quality and will not introduce new risks.

In doing this, PC/EH will consider the historical and existing use, the current circumstances of the land, the proposed end use and the potential for contamination to

be encountered during development works. PC/EH will ensure the developer undertakes the appropriate assessment and remediation of land contamination in line with good practice procedures and guidance.

An example of the land contamination decision framework as part of the Planning Process is presented in Appendix A as a detailed flow chart.

The assessment and remediation of land affected by contamination through the granting of planning permission (with the attachment of associated land contamination conditions) should ensure removal of any unacceptable risks, including those covered by the Contaminated Land regime under Part 2A of the Environmental Protection Act 1990, and make the site suitable for its new use. As a minimum, after the new development has been completed, the land should be suitable for its new use and not meet the legal definition of Contaminated Land under the Part 2A regime.

### **1.2. Early Consultations**

The developer should contact PC/EH for early discussions, preferably at the pre-planning stage, to ensure that minimum information requirements and the land contamination assessment and remediation procedures, are fully understood. In addition, PC/EH may wish to visit the site, and this will present an opportunity for further discussions to take place.

PC/EH may recommend the applicant contacts other formal LPA consultees (for example EAW) for early discussions if there are relevant considerations.

### **1.3. Information Submissions**

As a minimum, it is recommended that the developer submits a Preliminary Risk Assessment (see Box 1) for the site with their initial planning application. This will assist with consideration of the application, without unnecessary objections or delays. It is likely that for land where one or more former uses may have given rise to land contamination, planning permission will be granted *subject to conditions*.

The LPA will need enough information to be confident that the site can be reasonably remediated *before* planning permission is granted. Where *significant* contamination issues are known or suspected, the LPA may require subsequent stages of the contamination assessment procedure to be completed *before* the application is determined (see Box 1). In such circumstances a conditional grant of planning permission will not be appropriate.

Land contamination conditions are pre-construction phase conditions (*'conditions precedent'*) which seek to ensure that all of stages of the land contamination assessment and remediation process (see Box 1) for the site are undertaken prior to the commencement of construction works at the site. It may be necessary for the developer to submit information at key stages, in order to progress to the next. Information should be submitted in a timely manner to ensure LPA consultees have sufficient time to review and agree a way forward. These timescales should be agreed as part of conditions compliance.

The developer should be mindful that failure to provide sufficient information in a timely manner during the planning process may result in significant delays and increased expense for the developer.

The land contamination condition(s) may include, but not be limited to; site characterisation and risk assessment, remediation strategy, unexpected contamination, gas monitoring and protection, imported materials, verification reporting and long-term monitoring. PC/EH may recommend amendments to standard land contamination conditions, depending on the individual circumstances of the site.

#### **1.4. Choosing a Competent Consultant**

Many stages in the assessment and remediation process require input from experts and specialists who are appropriately qualified competent professionals. The developer should think about the full range of technical expertise that is likely to be required, when sourcing consultants or advisors to provide advice on the assessment, management and remediation of the site. The selected consultants should have professional indemnity insurance. The WLGA and EAW do not make official approval or recommendation for any consultancy, however some useful contacts can be found at [www.endsdirectory.com](http://www.endsdirectory.com) or via the yellow pages.

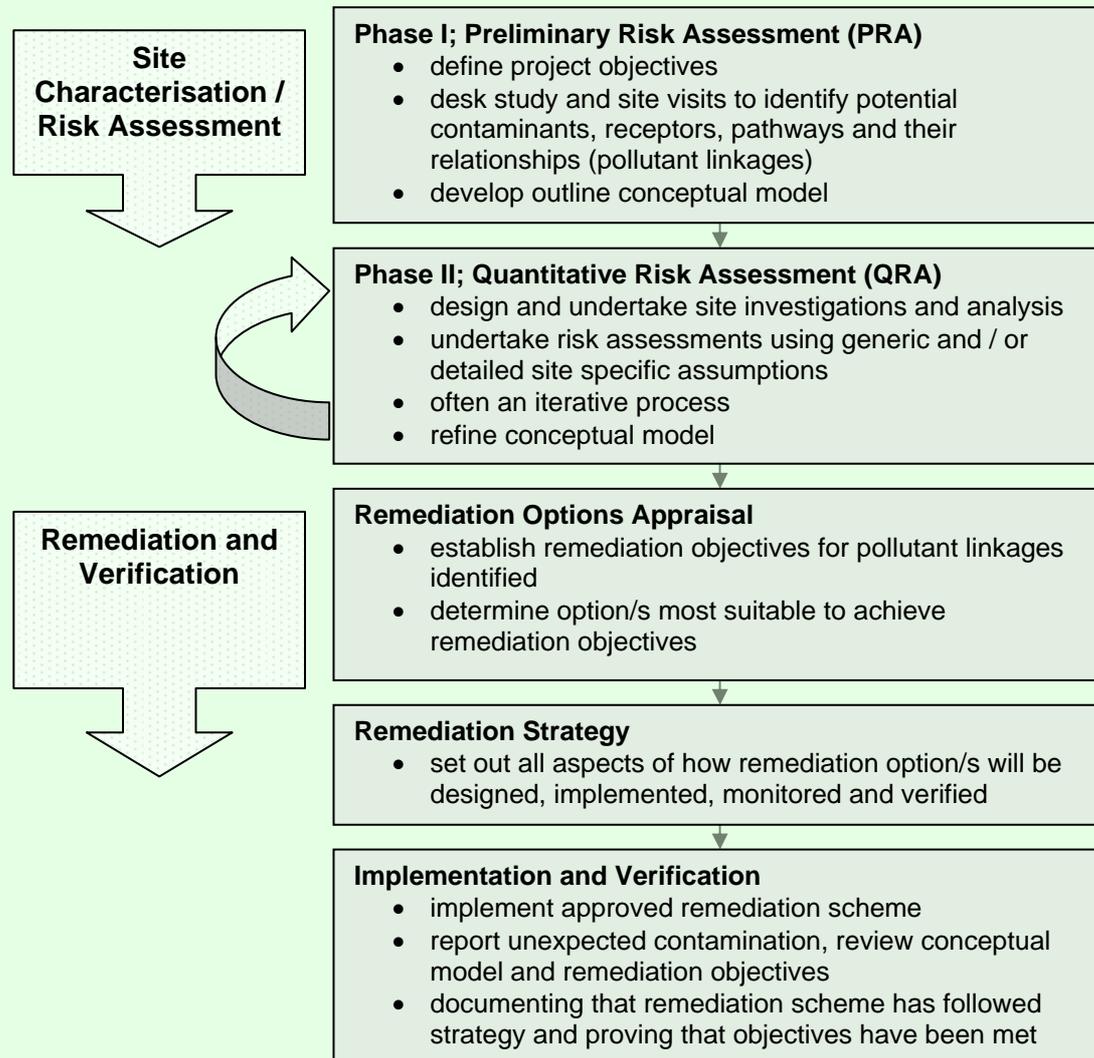
A development project is more likely to be successful, and considerable effort and expense spared, if appropriately qualified experts with relevant environmental experience are used at appropriate stages.

## **2. LAND CONTAMINATION MANAGEMENT PROCEDURE**

This section aims to give an overview of the risk assessment and remediation process required for effective land contamination management. The land contamination management process presented in this guidance document is consistent with current best practice guidance documents, for example; Model Procedures for the Management of Land Contamination CLR11 (Defra & Environment Agency 2004), Guidance for the Safe Development of Housing on Land Affected by Contamination R&D 66 (NHBC and Environment Agency 2008) and GPLC Parts 1 - 3 Guiding principles for land contamination (Environment Agency 2010). It is recommended that developers and their consultants refer to these documents for more detailed advice and guidance.

Box 1

## Land Contamination Management Procedure



### 2.1. Risk Assessment

Risk assessments help you decide whether land contamination is currently a problem, and/or is likely to be a problem during and/or following development of the site. Understanding the risks is the first step in the process of managing land contamination.

#### 2.1.1. Phase I - Preliminary Risk Assessment

The purpose of the preliminary risk assessment is to develop an outline conceptual model (see Box 2) and identify all plausible contaminant-pathway-receptor pollutant linkages at the site. This will be a qualitative (descriptive) assessment of risk.

The main activity at this stage is a 'desk study', comprising the collection of all readily available historic and environmental information. A site walkover survey is also usually undertaken, to verify the desk based information and observe any visual signs for

contamination. It may also aid design of the subsequent investigation by providing information that may limit or restrict the initial scope (for example access restrictions, services, location of concrete structures that may need penetrating).

Box 2

### CONCEPTUAL MODEL

The conceptual model is an understanding of the three-dimensional site characteristics (usually expressed through visual representation), which identifies potential sources of **contamination**, **receptors**, contaminant migration or exposure **pathways**, and shows the possible interaction between them (**potential pollutant linkages**), taking into account the current and proposed uses of the site.

The development of the conceptual model is an iterative process, which should be re-addressed and refined with each subsequent phase of assessment.

It is anticipated that a preliminary risk assessment will be required for most cases of development on brownfield land, and further assessment is required if there are any gaps in the preliminary risk assessment, or if the preliminary risk assessment identifies any potential unacceptable risks. A high degree of confidence in the preliminary risk assessment findings is usually required to demonstrate that any other outcome is acceptable.

Refer to Checklist 1 in Appendix B when submitting information in regard of a Phase I Preliminary Risk Assessment

#### 2.1.2. Phase II - Quantitative Risk Assessment

Phase II site investigation and risk assessment should be undertaken where the preliminary risk assessment identifies any potential unacceptable risks, or to reduce uncertainty in the initial conceptual model. The investigations should aim to provide information to refine and update the outline conceptual model, confirm and evaluate the significance of the identified potential pollutant linkages.

The scope of the site investigation should be designed around the preliminary conceptual model and should be agreed with PC/EH prior to undertaking the works. The site investigation should meet the requirements of the Code of Practice for Land Contamination of Potentially Contaminated Land BS10175 (British Standards 2011) and an MCERTS accredited laboratory must be used for analysis of soil samples.

The site investigation may be an iterative process, undertaken in several phases depending on the requirements for further reducing uncertainty in the conceptual model and refining the risk assessment from a generic quantitative risk assessment to a detailed quantitative risk assessment using site specific assessment criteria. Additional site investigation may also be required to provide data to inform the Remediation Options Appraisal.

In order to avoid delays and additional expense for the developer, it is recommended that prior to running risk assessment models (for example CLEA v1.06 and the EA Remedial Targets Methodology), key input parameters are agreed with the LPA consultees in advance.

## Human Health Assessment

The EA Science Report SCO50021 series of documents, SR2 to SR7 listed below, provides guidance on assessing the risks to human health. The SR documents are authoritative and have a published scientific basis, and therefore meet the requirements of the risk assessment framework set out in DETR (2000). The SR guidance is currently considered 'best practice' in the assessment of contaminated land in the UK.

*SR2 - Human Health Toxicological Assessment of Contaminants in Soil*

*SR3 – Updated Technical Background to the CLEA Model*

*SR4 - CLEA Software (Version 1.06) Handbook*

*SR7 - Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values*

## Controlled Waters Assessment

There are many methods and tools available, but you should choose ones that are appropriate for the UK risk management framework. EA documents that describe approaches or tools for water risk assessment include:

*Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination (2006)*

*Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrogeological Risk Assessment (2010)*

*Technical Advice to Third Parties on Pollution of Controlled Waters for Part 2A of the Environmental Protection Act 1990 (2002)*

Refer to Checklist 2 in Appendix B when submitting information in regard of a Phase II Quantitative Risk Assessment

## 2.2. Remediation

### 2.2.1. Remediation Options Appraisal

Where the quantitative risk assessment identifies that the nature and extent of land contamination is unacceptable for its intended end use, then remediation works will be required. The first stage is to establish the site specific remediation objective(s) that are required to address each pollutant linkage. Remediation criteria should be derived for measuring compliance against, which must be agreed with PC/EH and EAW as appropriate.

In order to avoid delays and additional expense for the developer, it is recommended that site specific remediation objective(s) and remediation criteria are agreed in advance by the LPA consultees.

A list of feasible remediation options should be produced for appraisal in order to establish which are most appropriate for addressing each pollutant linkage. The merits of each option should be assessed by compiling detailed technical information. The evaluation should also take account of the best practicable environmental option, cost benefit, environmental outcomes, site specific constraints and appropriate timescales for remediation, including obtaining likely regulatory requirements and permits.

The options appraisal should establish which option or combination of options will most effectively achieve the remediation objective(s).

Refer to Checklist 3 in Appendix B when submitting information in regard of a Remediation Options Appraisal

### **2.2.2. Remediation Strategy**

The remediation strategy sets out how the remediation option or combination of options, will address pollutant linkages and agreed remediation criteria. The strategy should provide a clear picture of how remediation activities will be planned for, implemented, monitored and verified. Practical issues such as phasing of activities, plans for obtaining appropriate environmental permits, compliance monitoring, contingency plans and mitigation measures etc. should be all addressed within the remediation strategy.

It is essential for the developer to demonstrate to the LPA that the remediation activities will be capable of achieving the agreed remediation criteria, without posing unacceptable risk to third parties or the environment, that appropriate permits will be obtained, contingency plans are in place and mitigation measures will be implemented if there are significant variations from the remediation strategy.

Refer to Checklist 4 in Appendix B when submitting information in regard of a Remediation Strategy

### **2.2.3. Remediation Scheme**

During development, PC/EH should be notified immediately under circumstances where contamination not previously identified is found to be present at the site. No further development (unless otherwise agreed in writing) shall be carried out until the developer has submitted, and obtained written approval from the LPA for a remediation strategy detailing how this unsuspected contamination shall be dealt with.

### **2.2.4. Verification Report**

Upon completion of the remediation works, a verification report must be submitted to the LPA consultees for review and approval. The verification report should provide a full record of all remediation activities carried out at the site and demonstrate that the agreed remediation criteria and objectives have been achieved. Only upon approval of the verification report can construction works take place.

Refer to Checklist 5 in Appendix B when submitting information in regard of a Verification Report

### **2.3. Long Term Monitoring and Maintenance**

Following completion of remediation works, where there is a requirement for long term maintenance and/or continued monitoring to demonstrate the effectiveness of those works, a separate 'Monitoring and Maintenance Plan' should be produced and submitted to PC/EH for approval by the LPA.

### **3. DEALING WITH GROUND GAS**

Ground gas is a contaminant and should be considered as a potential contaminant source in the preliminary risk assessment on sites where gas generation and/or migration is suspected.

The first stage is to provide the LPA with a preliminary risk assessment (as detailed in Section 2.1.1.). This should enable an appropriate site investigation and monitoring programme to be designed should a potential pollutant linkage be identified.

The gas monitoring programme should be designed to enable data to be gathered over a sufficient period of time with a suitable number of monitoring visits and at periods of varying atmospheric pressure. In addition, the numbers and position of monitoring locations, response zones and type of gas should be justified. CIRIA Report 150 provides guidance in relation to the position and selection of appropriate grid patterns. It is recommended that the gas monitoring programme is undertaken as outlined in Tables 5.5a and 5.5b of CIRIA 665 (p.60). The monitoring programme must be agreed in advance with PC/EH.

Where comprehensive characterisation of soil and/or groundwater contamination has identified a vapour risk, then appropriate risk assessment is required. The monitoring of vapours should be carried out in accordance to guidance within the CIRIA Reports C665 and C682, and British Standards 10381.

In order to avoid delays and additional expense for the developer, it is important that the gas monitoring programme is agreed in advance by PC/EH.

Following the completion of the agreed monitoring programme, an appropriate report must be forwarded to PC/EH, detailing the results of the monitoring, appropriate gas/vapour risk assessments and recommendations for protection measures, if required. Guidance is provided in CIRIA C665 for assessing gas data and CIRIA C682 for assessing vapour data.

A variety of gas/vapour protection measures are available and it is commonplace to use a combination of measures for a development (as no one single measure may adequately protect the development). It is essential to provide PC/EH with details and justification of the proposed gas protection measures in advance of installation. Once approved by PC/EH, the gas protection measures can be installed, but will require Building Control inspection to ensure satisfactory standard of installation as per Building Regulations (2000) (in which gas protection is included), and possibly NHBC sign off.

PC/EH will require the developer to verify that the gas protection measures have been satisfactorily installed as per the agreed designs. In addition, written approval of the satisfactory installation from the Building Control Officer should also be provided.

In order to avoid delays and additional expense for the developer, it is important that PC/EH is contacted for approvals in advance of key stages of work.

#### 4. REUSE AND IMPORTATION OF MATERIALS

The following section is applicable for developments where the importation of material is required for the purposes of garden, landscape or engineered cover systems. This also covers any site won materials which are to be reused on site.

The CL:AIRE Code of Practice (CoP) must be referred to if the developer intends to reuse site won materials. The CoP provides a clear, consistent and streamlined process which enables the legitimate re-use of materials on site with a significantly reduced regulatory burden. In many instances the CoP can provide an alternative to Environmental Permits or Waste Exemptions when seeking to reuse excavated materials on site. A registered 'Qualified Person' must be used.

For cover systems to protect end users, it is typical that a minimum 600mm cover will be required. In circumstances where the proposed depth is less than 600mm, the developer should demonstrate that receptors are protected with this shallower cover system by submitting a risk assessment. The proposals can only be undertaken with written approval from PC/EH via the LPA.

Topsoils to be imported should comply with British Standards Institution Code of Practice BS3882: 2007, Specification for topsoil and requirements for use.

Details regarding the source material to be imported, must be provided in writing to PC/EH via the LPA in advance of importation. Details should include sampling frequency, analytical results with full rationale and justification. The developer should refer to the WLGA guidance document 'Requirements for the Chemical Testing of Materials for Various End Uses' (2012), which presents the specific sampling frequencies for imported materials, dependent upon the quantities to be imported and their proposed use at a development. The document outlines the process for ensuring all information is submitted in relation to the relevant planning condition in a series of step by step actions. All verification reports should contain trial pit log details and photographic evidence of the capping depth.

The declaration form within the WLGA guidance document should be completed and returned to PC/EH. Adherence to the step by step actions in the document will ensure that risks associated with imported materials are avoided and greatly assist PC/EH to make a recommendation for discharge of the condition.

**Under no circumstances** should controlled waste be imported. It is an offence under Section 33 of the Environmental Protection Act 1990 to deposit controlled waste on a site which does not benefit from an appropriate environmental permit. The following must not be imported to a development site;

- Unprocessed / unsorted demolition wastes.
- Any material originating from a site confirmed as being contaminated or potentially contaminated by chemical or radioactive substances.
- Japanese Knotweed stems, leaves and rhizome infested soils. In addition to section 33 above, it is also an offence under the Wildlife and Countryside Act 1981 to spread this invasive weed.

Should the developer introduce a receptor (e.g. residential houses / human receptor) without undertaking necessary remedial work, then they may find themselves as an appropriate person and liable for subsequent remedial costs should the Local Authority later determine the site Statutory Contaminated Land under the Part 2A regime.

## 5. SUBMISSION OF REPORTS AND DISCHARGE OF CONDITIONS

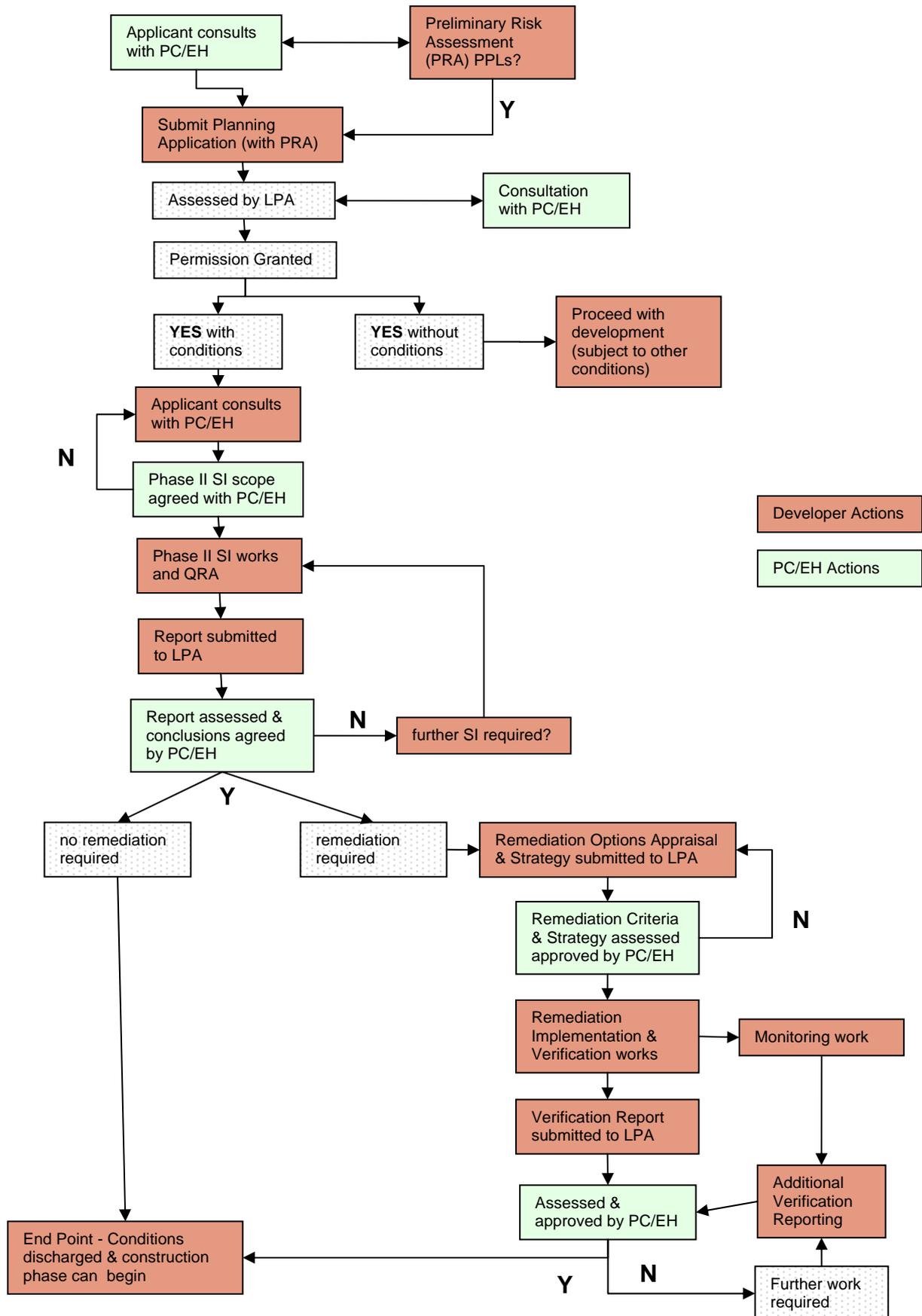
All formal submissions of reports and/or supporting information should be sent to the LPA, as original and complete versions of reports. In addition, electronic copies of reports and any supporting information is requested, for distribution to consultees.

PC/EH will make a recommendation to the LPA to discharge relevant condition(s) only upon receipt and approval of a satisfactory verification report. If at any stage of reporting, should PC/EH consider the assessment or findings of the report to be unsatisfactory then PC/EH is likely to reject the report and make a request for further information.

On those sites where a phased remediation approach of the site is proposed, it may be acceptable to provide verification reports to the LPA for each phase of remedial work at the site provided that a phased approach has been agreed in advance with the LPA.

## APPENDIX A

### Example land contamination decision framework as part of the Planning Process



## APPENDIX B

### CHECK LIST 1

<b>Phase I; Preliminary Risk Assessment /Desk Study</b>	Date Provided
<p>Objective: to obtain a good understanding of site history, setting, current and proposed use. Draw up an outline conceptual model to establish any relevant pollutant linkages in the contaminant-pathway-receptor human health and environmental risk assessment. Identify if further investigation and or remediation is required.</p> <p>Reporting requirements:</p>	
➤ purpose and aims of the study	
➤ credentials of person undertaking the study	
➤ site location and current layout plans (appropriately scaled and annotated with north point, National Grid Reference (minimum 6 figures) and site area in hectares)	
➤ description of site and surrounding land uses	
➤ appraisal of site walkover survey	
➤ review of site history including appropriately scaled and annotated historical maps and aerial photographs where available	
➤ details of current and proposed site use	
➤ assessment of the environmental setting including the interpretation and implications of: <ul style="list-style-type: none"> <li>• the geology, hydrogeology and hydrology of the area</li> <li>• information from the Environment Agency on abstractions, pollution incidents, water quality classification, landfill sites within 250 metres and flood risk</li> <li>• whether there are any archaeological or ecological considerations</li> </ul>	
➤ review of any previous site contamination studies (desk based, intrusive, or IPPC investigations where relevant) and remediation works	
➤ review of local authority planning records, building control records, drainage and service plans	
➤ identification of potential contaminants of concern and source areas	
➤ preliminary (qualitative) assessment of risks, to include: <ul style="list-style-type: none"> <li>• outline conceptual model to show the nature and extent of the potential contamination and</li> <li>• an appraisal of the potential relevant pollutant linkages (contaminants, pathways and receptors)</li> </ul>	
➤ identification of information gaps and uncertainties, recommendations for intrusive contamination investigations (if necessary) to include the identification and justification of target areas for more detailed investigation	

## CHECK LIST 2

<p><b>Phase II; Quantitative Risk Assessment / Site Investigation</b></p> <p>Objective: to refine and update the conceptual model, provide detailed site-specific information on substances in, on or under the ground, geology and groundwater, confirm relevant pollutant linkages, evaluate potentially unacceptable risks through generic or detailed quantitative risk assessment and provide the basis for the Options Appraisal.</p> <p>Reporting requirements:</p>	Date Provided
➤ purpose and aims of the study	
➤ credentials of person undertaking the study	
➤ site location and current layout plans (appropriately scaled and annotated, with north point, National Grid Reference (minimum 6 figures) and site area in hectares)	
➤ review and summary of any previous reports with references	
➤ results of preliminary risk assessment and summary of outline conceptual model	
➤ liaison with the Local Authority PC/EH	
➤ site investigation methodology to include: <ul style="list-style-type: none"> <li>• any preparatory enabling works e.g. breaking out concrete and demolition</li> <li>• an appropriately scaled and annotated plan showing exploration locations, sample points, site structures, above/below ground storage tanks and existing services, infrastructure etc.</li> </ul>	
➤ justification of both targeted and grid-based sampling strategies, including the location, depth and number of samples taken <ul style="list-style-type: none"> <li>• method of forming exploratory holes e.g. boreholes/trial pits and borehole/trial pit logs, showing water strikes and installation details as appropriate.</li> <li>• details of surface/groundwater monitoring programmes according to relevant Environment Agency methodology</li> <li>• methods of collecting, storing and transporting samples to laboratory</li> <li>• description of site works and observations</li> </ul>	
➤ justification of analytical strategies, including the selection of parameters and the selection of samples for additional tests such as leachability	
➤ analysis of samples to be carried out by an MCERTS accredited laboratory for soils and must include: <ul style="list-style-type: none"> <li>• all contaminants of concern identified in preliminary risk assessment</li> <li>• where relevant, the speciation for grouped determinands to allow for quantitative risk assessment e.g. polyaromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs)</li> </ul>	
➤ results and findings of investigation to include:	

<ul style="list-style-type: none"> <li>• description of ground conditions (made ground / soil and perched / groundwater regimes, including interactions between them)</li> <li>• flood risk</li> <li>• discussion of nature and extent of contamination - sensory field evidence and analytical, a summary of the phases (solid, dissolved, free and the potential mobility and leachability of contamination)</li> <li>• meaningful comparison (i.e. to include statistical tests as per UK guidance) of the analytical results to appropriate standards, with full justification of the standards chosen</li> <li>• to include consideration of ground gas and the presence of asbestos</li> </ul>	
➤ evaluation of site investigation results against conceptual model	
➤ site specific risk assessments for both health and environmental receptors. To include: <ul style="list-style-type: none"> <li>• objectives and details of proposed site use</li> <li>• details of the models selected and justification of choice for the site</li> <li>• justification for input parameters, with source reference for literature values and additional calculations for field derived parameters, assumptions, safety factors</li> <li>• any model printouts that have been generated (e.g. with the Contaminated Land Exposure Assessment Model CLEA and Remedial Targets Methodology, the data worksheets should be included)</li> <li>• parameter sensitivity analysis and validation reports to show that the model is performing accurately</li> <li>• note, where non-UK models are used, it will be important to make modifications to them ensuring compliance with UK policy. DEFRA publishes relevant guidance in CLR 7 to 11</li> </ul>	
➤ an interpretation and discussion of the findings of the investigation and risk assessment with identification of pollutant linkages that present unacceptable risk and discussion of uncertainties	
➤ recommendations, description and uncertainties for further investigations or next steps as appropriate	

### CHECK LIST 3

<p><b>Remediation Options Appraisal</b></p> <p>Objective: to establish which remediation option, or combination of options, provides the best approach to remediating all pollutant linkages that present an unacceptable risk at the site, whilst meeting best practice and current technical guidance.</p> <p>Reporting requirements:</p>	Date Provided
➤ purpose and aims of the report	
➤ credentials of person compiling the report	
➤ site location and current layout plans (scaled and annotated, with north arrow, National Grid Reference (minimum 6 figures), site area in hectares)	
➤ review and summary of all previous reports with references	
➤ results of site investigation and quantitative risk assessment report and summary of conceptual model	
➤ liaison with the Local Authority PC/EH	
➤ summary of relevant pollutant linkages that require remediation	
➤ outline of remediation objectives - what remediation needs to achieve for each pollutant linkage	
➤ outline of remediation criteria - against which compliance for each pollutant linkage can be measured and statement of overall site remediation criteria	
➤ identification of feasible remediation options	
➤ detailed evaluation of remediation options	
➤ description of remediation strategy, including: <ul style="list-style-type: none"> <li>• justification for selection and how remediation strategy will deliver overall site remediation criteria</li> <li>• technical and scientific basis, effectiveness of combining remedial options, constraints and limitations, expected durability</li> <li>• site plan/drawings (appropriately scaled and annotated)</li> <li>• preparatory works, phasing of remedial works and timescales</li> <li>• consents and licenses (e.g. discharge consents, part B authorisation for mobile plant, waste management licences/exemptions, asbestos waste removal licence)</li> <li>• site management measures to protect neighbours, environment and amenity during works, including where appropriate: health and safety procedures, discharges to air, land and water including dust, noise, odour, surface water run off, discharges to groundwater with environmental controls and monitoring</li> </ul>	
➤ outline of how remedial strategy will be verified and future monitoring requirements	
➤ details on the lifespan of the remediation strategy	
➤ note: If changes are made to the remediation strategy they must be agreed with the local planning authority before they are implemented, justification will be required, with description of how the amended strategy will meet the agreed remediation criteria	

## CHECK LIST 4

<p><b>Remediation Strategy</b></p> <p>Objective: to clearly translate the remediation strategy into a clear set of remediation activities for the site. It should set out all aspects of the design, preparation, implementation, verification and long-term monitoring and maintenance of the remediation strategy.</p> <p>Reporting Requirements:</p>	Date Provided
<p><b>Implementation Plan:</b></p>	
<p>➤ purpose and aims of the report</p>	
<p>➤ credentials of person compiling the report</p>	
<p>➤ site location and current layout plans (appropriately scaled and annotated, with north point, National Grid Reference (minimum 6 figures) and site area in hectares)</p>	
<p>➤ review and summary of all previous reports with references</p>	
<p>➤ liaison with the Local Authority PC/EH</p>	
<p>➤ description of ground conditions including geology, hydrology and hydrogeology</p>	
<p>➤ remediation objectives; criteria for relevant pollutant linkages and overall site criteria</p>	
<p>➤ remediation methodology</p>	
<p>➤ site zoning and phasing with approximate timescales</p>	
<p>➤ preparation works and operational constraints</p>	
<p>➤ specific site management procedures and emergency contingency plans</p>	
<p>➤ site management measures to protect neighbours, environment and amenity during works, including where appropriate: health and safety procedures, discharges to air, land and water including dust, noise, odour, surface water runoff, discharges to groundwater with environmental controls and monitoring</p>	
<p>➤ location and construction details of monitoring activities eg. dust gauges, vapour monitoring, groundwater boreholes</p>	
<p>➤ details of permits and licences in place and how compliance will be demonstrated</p>	
<p>➤ detailed site plans/drawings (appropriately scaled and annotated) showing areas requiring remediation, locations and phasing of works, stockpiling, monitoring and sampling points</p>	
<p>➤ details of what constitutes completion of remedial works and how completion will be verified</p>	
<p><b>Verification Plan:</b></p>	
<p>➤ details of the Verification Plan in order to demonstrate that the remediation criteria has been met for each relevant pollutant linkage, including details of :</p> <ul style="list-style-type: none"> <li>• the sampling and monitoring strategy, methods and frequency</li> <li>• validation testing of excavations to remove material, treated material, imported material, effectiveness of gas management systems etc.</li> </ul>	

<ul style="list-style-type: none"> <li>• water quality testing of background groundwater and proximal surface waters, plus treated waters</li> <li>• the use of on-site observations, visual/olfactory evidence</li> <li>• schedule of chemical analysis, demonstrating accordance with MCERTS for soils and laboratory QA/QC</li> <li>• performance testing methods e.g. for containment barrier (cut off wall, gas membrane) and capping layer</li> <li>• confirmation by independent consultant that remedial measures proposed ie for gas, soil or water contaminants are incorporated into the design as planned or as per manufacturers specification. Any deviation to this being justified.</li> <li>• proposed actions in the event that verification shows failure of remediation criteria</li> </ul>	
<p><b>Monitoring and Maintenance Plan:</b></p>	
<ul style="list-style-type: none"> <li>➤ details of future monitoring and or maintenance requirements in a Monitoring and Maintenance Plan (where necessary) once remediation has been completed, including details of : <ul style="list-style-type: none"> <li>• explanation as to why work is required</li> <li>• scope of sampling and monitoring and / or maintenance, methods, frequency and type of equipment to be used</li> <li>• statement and justification for end-point for monitoring programme</li> <li>• proposed assessment criteria and justifications for selection</li> <li>• schedule of chemical analysis, demonstrating accordance with MCERTS for soils and laboratory QA/QC</li> <li>• measures for ensuring required monitoring / maintenance is undertaken</li> </ul> </li> </ul>	

## CHECK LIST 5

<p><b>Verification of Completion</b></p> <p>Objective: to clearly demonstrate that the remediation activities have been completed satisfactorily, have not caused harm to third parties and the environment and that the remediation criteria for each of the relevant pollutant linkages have been met.</p> <p>The <u>Verification Report</u> should include:</p>	Date Provided
➤ purpose and aims of the report	
➤ credentials of person compiling the report	
➤ site location and current layout plans (appropriately scaled and annotated, with north point, National Grid Reference (minimum 6 figures) and site area in hectares)	
➤ review and summary of all previous reports with references	
➤ liaison with the Local Authority PC/EH	
➤ information as detailed in the remediation strategy including description of relevant pollutant linkages assessed, i.e; <ul style="list-style-type: none"> <li>• description of ground conditions including geology, hydrology and hydrogeology</li> <li>• remediation objectives; criteria for relevant pollutant linkages and overall site criteria</li> <li>• remediation methodology</li> </ul>	
➤ details of remedial work undertaken and by whom, with justification for any changes from the original remediation strategy	
➤ results of verification, validation, performance testing and monitoring as specified in the <u>Verification Plan</u> : to include substantiating data: <ul style="list-style-type: none"> <li>• laboratory and in-situ test results, monitoring results for groundwater and gases during remediation</li> <li>• summary data plots and tables relating to remedial criteria</li> <li>• plans showing treatment areas and details of any differences from the original remediation strategy</li> <li>• details of permits, licences, waste management documentation etc. and demonstration of compliance</li> </ul>	
➤ description of reinstatement works	
➤ description of final site conditions at completion with details of any permanent installations that form part of the remedial strategy and are to be left intact	
➤ confirmation that remediation objectives have been met and confirmation of post-completion monitoring/ maintenance requirements	

## APPENDIX C

### References and Recommended Guidance

- British Standards Institution (2011) Investigation of Potentially Contaminated Sites, Code of Practice, BS: 10175:2011
- British Standards Institution (2010) Amendment 2: Code of Practice for Site Investigation, BS5930:1999+
- British Standards Institution (2007) Specification for Topsoil and Requirements for Use, Code of Practice, BS: 3882:2007
- British Standards Institution (2002) Soil quality. Sampling. Guidance on sampling techniques, Code of Practice, BS: 10381:2002
- Chartered Institute for Environmental Health (2008), The Local Authority Guide to Ground Gas
- CIRIA Report C665 (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings
- CIRIA Report C685 (2009) The VOCs Handbook
- CL:AIRE & Chartered Institute for Environmental Health (2008) Guidance on Comparing Soil Contamination Data with a Critical Concentration
- CL:AIRE (2011) Definition of Waste: Development Industry Code of Practice
- Department of the Environment (1989) Waste Management Paper No 27, Landfill Gas
- Department of the Environment (1995) Industry Profiles
- Environment Agency (2010) Guiding Principles for Land Contamination
- Environment Agency (2004) Model Procedures for the Management of Land Contamination (CLR 11)
- Environment Agency (2006) Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination
- Environment Agency (2010) Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrogeological Risk Assessment
- Environment Agency (2002) Technical Advice to Third Parties on Pollution of Controlled Waters for Part IIA EPA 1990
- Environment Agency (2005) Science Report P5-080/TR3, The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons for Soil
- Environment Agency (2003) MCERTS Performance Standard for Laboratories Undertaking Chemical Testing of Soil
- Environment Agency (2009) Science Report SC050021/SR2, Human Health Toxicological Assessment of Contaminants in Soil, Background to the CLEA Model
- Environment Agency (2009) Science Report SC050021/SR3, Updated
- Environment Agency (2009) CLEA Software Handbook version 1.04

- Environment Agency, National House Building Council and Chartered Institute for Environmental Health (2008) Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66:2008
- Health and Safety Executive (1991) Protection of Workers and the General Public during the Development of Contaminated Land
- Raybould JG, Rowan DL & Barry DL, 1995, CIRIA Report C150, Methane Investigation Strategies
- Welsh Assembly Government (2006) Statutory Guidance on Contaminated Land
- Welsh Local Government Association (2012) Requirements for Chemical Testing of Imported Materials for Various End Uses
- Wilson S, Oliver S, Mallett H, Hutchings H & Card G, 2007, CIRIA Report C665, Assessing Risks Posed by Hazardous Ground Gases to Buildings

Note: This list is not exhaustive but summaries some of the key reference and guidance documents that the developer and their advisors should refer to.